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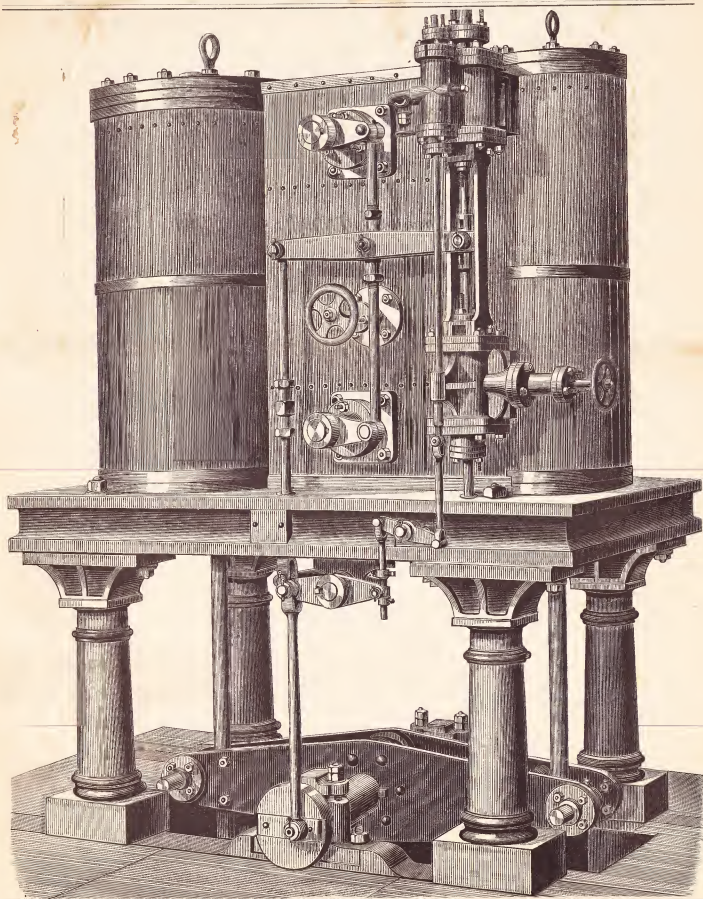
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The chief reasons why our patent business has grown up to such importance are that, united to a long experience in the business, we devote very careful attention to the study and preparation of our cases. In addition to this care and study, we do not abandon the interest of our clients after their applications are filed in the Patent Office. We have the advantage of the best service at Washington to look after all the requirements of the Commissioner.

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The Papaw Tree.

It would seem that an important aid to digestion for dyspeptics has been found in the milky juice of the papaw tree (*Carica papaya*), cultivated on the woody slopes of the Andes. The juice contained in the fruit averages from 25 to 30 per cent of the entire weight. The juice has a powerful solvent action upon nitrogenous substances, exceeding pepsin in this respect, if the account given of it be true. No acid is needed to aid its digestive action, which is so powerful that (according to Dr. L. Wittmark, of the Royal Agricultural Museum at Berlin, who has investigated the subject) when ten grammes of fresh lean beef in one piece were placed in the juice diluted with three times its weight of water and boiled five minutes, the beef separated into coarse pieces before the boiling point was reached, and into fine shreds before the termination of the experiment. Hard boiled shlamen digested with a little of the juice at 36° F. could, after twenty-four hours, be easily broken up with a glass rod.

Fifty grammes of beef in one piece, enveloped in a leaf of the papaw during twenty-four hours, at a temperature of 15° C., after a short boiling became perfectly tender; a similar piece wrapped in paper and heated in the same manner, remained quite hard. Some comparative experiments were also made with pepsin, and the following conclusions arrived at: the milky juice of *Carica papaya* contains a ferment which has an extraordinary energetic action upon nitrogenous substances; it differs from pepsin in being active without the addition of a free acid, and, further, it operates at a higher temperature and in a shorter time.

Accordingly, the action of this substance is taken advantage of by Brazilian butchers to make their very tough meat salable.

The tree flourishes not only in tropical America, but also nearly everywhere in India, where it is cultivated in gardens for its fruit, which is eaten both green and ripe, variously prepared.

Refrigerating Apparatus on Board the Steamship *Circassia*.

This successful transportation to England of three pistons of beef on the steamer *Circassia*, of the Anchor line, by means of a refrigerating apparatus manufactured by Bell & Coleman, of Glasgow, Scotland, which apparatus employs neither ice, volatile liquids, or other chemical refrigerating agents, has attracted much attention, and has led, we are informed, to an order for fitting out all the ships of the Anchor line with a similar apparatus.

The *Circassia* sailed from this port on the 12th ult. with her fourth shipment of beef, of over twelve hundred quarters. The beef is said to have arrived in admirable condition, and to have brought a penny per pound more in the English market than could be obtained for beef preserved by other means.

The apparatus employed belongs to that class in which air is compressed, then cooled in the compressed state, then expanded in an engine cylinder to further extract its heat by the performance of work, the work being applied to the compression of the air. This work is supplemented by work of steam engines also applied to air compression. There are two steam engines, two air-expanding engines and two air-compressors. The pistons of the air-expanding engines are directly connected with the pistons of their respective compressors. The steam engines work cranks attached at right angles to a fly-wheel shaft, which also applies its power to the piston-rod of the compressors.

The air is so well informed by the superintending engineer taken from the refrigerating chamber, then compressed, then cooled by injected water, then conveyed through a series of copper pipes enclosed in the refrigerating chamber, then induced to the air-expanding engines, then exhausted broadcast back into the refrigerating chamber, where it is distributed through chutes as uniformly as possible to all parts of the room. The purpose of sending the air after compression through the series of copper pipes placed in the refrigerating compartment was stated to be the removal of water-vapor therefrom, so as to avoid freezing up of the air engines, the water of condensation being trapped out of these pipes. It is difficult, however, to see merit in this feature of the apparatus. Such water as may be carried over mechanically into the pipes might of course drip away, but the air of the room at the commencement of the process (which is the time the drying is most needed) is or should be hotter than the compressed air, and there can be in such case no actual precipitation of water-vapor from the air. Let us in the process the air in the refrigerating room will be colder than the compressed air passed through the pipes; precipitation of moisture will then take place, but only through heat imparted to, not abstracted from, the room. The same result as is now obtained would take place by passing the air through cooled pipes exterior to the room, and would, we think, be an improvement on the present arrangement, as the air would then pass through the air engines as dry as it now does, and a greater cooling effect would be secured in the refrigerating compartment.

However, this kind of cooling bids fair to inaugurate a new era in the transportation of perishable commodities, and will, we believe, for such purposes, entirely supplant all systems of ice-cooling or production of cold by chemical agents.

The Reformation of Criminals.

Criminals may be divided into two classes: the naturally perverse, and those who, with no preponderating tendencies to evil inherited from criminal ancestors, have been corrupted by evil associations and strong temptations. Both classes ought to be sincerely pitied by their more fortunate fellows.

There are two ways of dealing with criminals

practiced from time immemorial: their final removal from society by death, and temporary exclusion from the ordinary privileges of citizenship by imprisonment, banishment, etc.

The savage principle of vengeance was long the governing motive of punishment inflicted for crime. Justice and mercy must have been the sentiment. Not only were brutal and sanguinary punishments inflicted, but the infliction was conducted publicly and in such manner as to inflame the ignoble passions of revenge.

With the growth of civilization and the spread of scientific knowledge a great change has been wrought in public opinion relative to the status of the criminal classes. The distinction made in the first paragraph of this article has come to be clearly recognized, and the terms of the problem of dealing with convicts have assumed the following form:

1. How shall society treat its refractory members who are capable of reform?
2. How shall society rid itself wholly of such refractory members as are incapable of reform?
3. How shall society prevent the existence and multiplication of an irreformable criminal class?

The two former terms of the problem look to remedial measures for existing evils; the latter seeks a prophylactic against their recurrence. Science is fully competent to supply the necessary preventive, could we but fix upon a criterion by which we could accurately discriminate between the naturally and incurably vile, and those capable of reformation to the better.

Our statutes attempt to make such a discrimination. It is to be assumed that the possibility of reform is conceded to all such as are condemned to less than capital punishment. However, it is a matter of daily observation that the grossest imperfections are inherent in our system of penalties. On the one hand, it grants the brutal bargainer, who in cold blood attempts the life of sleeping innocence, if he fails in the attempt, a term of existence in a prison cell, from which, if he lives to regain freedom, he will most probably issue to commence fresh aggressions upon the community. On the other hand, from the man who, after having led an honest and blameless life, is wrought upon by wrongs till in his torture he seeks and takes the life of the one that has robbed him of wife or property, or has, perhaps, destroyed the innocence of a beloved child, it exacts the full death penalty.

This imperfection of the present system of penalties is so vividly present to the public mind, that in most cases, wherein a sentence is known to have sought redress from certain injuries, or which adequate redress cannot be obtained through legal process, public opinion supplants law, and juries refuse to convict, glacially accepting the plea of insanity in behalf of the prisoner, as a loophole of escape from the penalty of the statute.

The whole subject of the treatment of criminals is likely to receive more than a passing consideration at this time, because of the able, graceful and humane discourse delivered to the convicts at Auburn State Prison on the 4th of July, by the Hon. Horatio Seymour.

We should be glad to discuss the points of this remarkable address at length, but can only say of it, that with a total absence of cant and phariseism, it breathed only the pure spirit of benevolence, recognizing the weakness of those who do not fall and the helplessness of those who do.

"Write me as one who loves his fellow-men," was the humble and modest request of Abou Ben Adhem, and when the angel next disclosed the shining robes of his saintly resting place. No one can read the earnest remarks of Ex-Gov. Seymour without the feeling that they were uttered by a lover of his race, whose sympathies are broad enough to include even the fallen. And no lover of his kind can rise from such a perusal without the feeling that enlightened philanthropy should resolutely grapple with the question of making our prisons reformatory instead of confimatory institutions, as there is too much reason to fear they now are.

Drying Processes and Patents Relating Thereto.

No. 4.

The attraction of water-vapor by air is independent of the action of the heat. It is nevertheless true that warm air, conditioned to get all the moisture it can hold, will contain more moisture than cold air under the same conditions. The reason for this is that water-vapor which is produced by the action of heat will penetrate the intermolecular spaces of the air, in the same manner that it would enter the same space were no air present. This is quite a different action from that of condensation by which air removes moisture, and which is probably not much affected by moderate changes of temperature. By virtue of its universal distribu-

tion, availability and effectiveness as a carrier of moisture, air is by far the most generally employed medium in drying processes.

Patents for drying apparatus more or less conforming to the scientific principles we have stated are quite numerous. Many evince great ignorance of fundamental principles of the science of processes, in which precise construction of apparatus is not an essential feature are less numerous. Without observing any chronological order, we will briefly glance at some of these processes.

In 1871 Mr. H. C. Northburgh, N. Y., obtained a patent for a process and apparatus for drying and preserving animal and vegetable substances. Heated and humid air was employed to effect partial evaporation of the moisture from the substances, the humidity of the air being gradually increased as the heat of the same was decreased, the air-current being maintained by screens moving in a current or tower, or by a fan-blower, and the air being heated by coils. The effect of such a process would be the partial or entire coagulation of albuminous matters, and evaporation of moisture more uniformly throughout the mass of the substance than could be done in very dry air, which would act upon the surface more than upon interior moisture. Very good results have, we are informed, been reached by this process, in quality of the fruits, etc., subjected to it.

As an illustration of the large range of physical principles involved in drying processes, the process patented by Dennis Rice, of Shelburne Falls, Mass., September 30, 1867, may be cited.

There are two kinds of heat, luminous and obscure. The former is accompanied by luminosity, the latter is not. By far the greater quantity of heat derived from the sun is luminous. The absorption of luminous heat by an opaque body renders it obscure. Luminous heat passes readily through glass; obscure heat is greatly obstructed by glass. Availing himself of these principles, Mr. Rice constructed a drying box or apartment with a glass lid or door, etc., permitting the inward passage of luminous heat, prevented its outward passage after its conversion into obscure heat. In addition to this, means for supporting the substances to be dried and the circulation of the air over the same were included in the combination for which the patent was granted. We doubt not drying by solar heat were thus facilitated.

The invention of H. G. Baskley, patented October 22d, 1867, has given us good results for all substances which are not injured by heat in drying. Air heated by the direct conningling of the same with steam is first admitted, which all free moisture is soon converted into steam, and the steam from the enclosure, except such as fills the space in the form of vapor. This is soon carried away by dry air passed through the enclosure. This method, besides many other useful applications, is peculiarly adapted to the rapid and thoroughly seasoning of green lumber, which it effects in a few hours. The heat, moreover, converts the soluble albumen in the wood into coagulated insoluble albumen, which greatly adds to the stability of the lumber.

As we have intimated, patents for drying processes independent of apparatus employed are rare in the records of the Patent Office. Probably as the knowledge of principles becomes more generally diffused, their number may increase somewhat by the union or combination of different principles as steps of a process considered as a whole.

The Weighting of Silk.

THOUGH most retail purchasers of silk are aware that much caution is necessary to avoid deception in the quality of silk, very few know the extent to which fraud is carried by manufacturers. A French publication, *Moyens de Sevoir*, has been turning the light and revealing the mysteries of silk-weighting, which is the euphemism by which this kind of cheating is known to the trade. The following is an abstract of an article from the journal named:

At first sight it might appear that articles of white silk must be, like Caesar's wife, above all suspicion. It is nothing of the sort. Cheats are ingenious, and with little else have arrived at results which, without equalling the height reached in other branches, threaten much for the future.

The most ancient method of loading whites consists in the use of refined starch-sugar, or of cane-sugar. By taking silks through a solution of sugar, they gain about 15 per cent. in weight. This operation is done last, and the silks are dried out of the sugar, after having been well squeezed and whizzed. This process cannot be accused of injuring the strength of the silk, but, instead, it yields goods claimy to the touch, and drenching rain-spots more than pure silks. In damp weather, they absorb moisture, and attract flies to some ex-

tent, if there are any. It is true that by impregnating the solution of sugar with quassia they may be made to do duty as fly papers—a compensation not to be disdained. You see how the progress of science has succeeded in creating a new "mission" for ladies. If dressed in white silks, weighted with sugar and quassia, they are safe in riding the world of insect pests.

In these latter days sugar has found a rival in glycerine. By degrees it has been rendered colorless, and freed from its primitive odor, too strongly smelling of bladders. It is used in the same manner as sugar, and is open to the same inconveniences. The use of deliquescent salts, such as the chloride of magnesium, enables the silks to remain somewhat damp even in the driest weather, and is thus a fresh means of gaining a few per cents.

This method of loading whites is used for all kinds. When applied to raw silks it is clear gain; and in case of ungummed silks it compensates for a part of the loss sustained in that process.

Latterly much use has been made of a weighting known as X, which we are now about to examine. At the outset, say ten years ago, the X weighting was applied by taking the silks through a very strong solution of perchloride of tin, rising in abundance of water, and soaping at a boil. The weight taken up may be 20 per cent. We may be reminded that "sappetier" (by which it is called) and it became customary to take the silk twice through the tin solution, the first time while still in its raw state. The soaping process freed the tin at the same time as it ungummed the silk. The first tin bath made up for the loss sustained in soaping, and the second was clear gain. A third tin bath was even tried, but in this case the weight was too much injured. A further step was substituting pink-salt (double chloride of tin and ammonium) for common perchloride of tin, as it was less hurtful to the hands of the work-people.

The weighting X has only a moderate success in its practice, but, as it is limited in extent. In fact, the silk gains weight, but it does not increase in bulk to a corresponding degree. The oxide of tin fixed on the fibre is very dense, and this is precisely what is not wanted. The manufactured goods thus weighted rapidly lose their qualities, and soon they are only valuable as ores of tin, being very rich in that metal.

We are now about to enter into some dry calculations, and to show the weighting is reckoned, and how it ought to be reckoned, and upon what basis the dyed silks of the present day ought to be sold.

A manufacturer sends a quantity of silk to the dyer to be dyed black. Let us suppose 100 lbs. of raw silk to be sent to the dyer. If he does not return 100 lbs. it is said that the silk has lost in dyeing; if he returns more than 100 lbs., it is said to have gained, and the mere increase is taken into account. Thus, if the dyer sends back 125 lbs., it is said to have gained 25 per cent. Thus the original weight of the silk before dyeing is taken as the basis; anything less is considered as a loss, and anything above is considered as gain. Let us suppose the silk may seem just and rational, but it is by no means so from the dyer's point of view. Let us suppose that a dyer has received 100 lbs. of raw silk and sent back 150 lbs. This, according to the above way of looking at the transaction, is a weighting of 50 per cent., and is called a "half-heavy," and considered a moderate, and, if you will, an honest weighting. But an experienced buyer will not share this opinion, and he will tell you that this 50 per cent. is in reality 100 per cent., sold under false pretences.

What does it matter to the buyer that 100 lbs. have been sent to him? What concerns him is what remains of it after soaping. If that remains a medium loss of 25 per cent. in ungumming, then of the original 100 lbs. of raw silk there will remain only 75 lbs., and if the lot is then weighted up to 150 lbs., the addition is, of course, cent. per cent.

TIMEKEEPERS.

Chronometers—John Harrison's Struggles and Success—The Laminated Balance—Secret of Timekeeping—Testing Chronometers.

In our article of June 1st, on "Timekeepers," we gave an idea of what Mr. Bradley has done with clocks and watches. To complete the subject we here present some passages from his remarks on Chronometers on the same occasion.

STRUGGLES OF AN INVENTOR.

On the 11th of June, 1774, said Mr. Bradley, the House of Commons of England appointed a Committee to consider the subject of exact time, and a timekeeper of sufficient accuracy to determine the

longitude at sea. Sir Isaac Newton was one of its members. At the suggestion of the Commissioners an act was passed, granting to any person who discovered a method of finding the longitude, within 60 geographical miles, the sum of £10,000; within 40 miles, £15,000; and within 30 miles, £20,000; these being a voyage from Cape Britain to any port in America named by the Commissioners.

These immense rewards stimulated the horological fraternity to extraordinary exertions, but the stumbling-block was, granting to any person who discovered to which the machine must be subjected on such a voyage.

Weeks, months, years passed away, and there was no response to the reward, until in 1781 Harrison, the modest, obscure son of a Yorkshire carpenter, wended his way up to London, to present himself before the Board of Longitude, and exhibit to them some drawings he had made of a machine to find the longitude at sea. He was in hopes of being furnished with means, or of being employed to make one. But very little notice was taken of him, and after much buffeting and bandying about, he was finally told to call on George Graham, the then most celebrated horologist in England.

With much trepidation he presented himself before that gentleman, and exhibited to him the drawings of his machine. Graham was delighted, and advised him immediately to return home and construct one. Aye, there was the rub! How was the poor mechanic to get the money and time to construct his machine, and at the same time to provide for the wants of his family? He had come up to London expecting to be taken by the hand and furnished with the means to construct his timekeeper; instead of which he had found himself to welcome him, and but just one kind word to cheer him on. He wended his way back to Yorkshire with a heavy heart, and he went no more of the name of John Harrison for seven years. How he ceaselessly toiled, and how himself and his family suffered from want and privations during those long seven years, we know not; but at the end of that time he once more wended his way up to London with a small box under his arm, the result of his labors, and once more presented himself before Mr. Graham, the man who had befriended him in word if not in deed.

Graham, Hailey and others examined the machine, and were well pleased with the precision of its movements and the plan of compensation for change of temperature, that upon their recommendation he was granted permission to proceed to Lisbon on a voyage, and to test the accuracy of the performance of his instrument enabled him to correct an error in the ship's reckoning of a degree and a half.

The success of this voyage induced the Government to grant him £5,000 to continue his experiments, and he was also given a gold medal as a reward of merit for his very curious clock for finding the longitude at sea.

The encouragement Hailey proceeded to build three more timekeepers, the last of which attained such accuracy that he applied for permission to proceed on a voyage to the West Indies, to test it, and compete for the large reward. This was granted, but he was advised, on account of his age, 68, to let his son go in his stead.

After 18 days' sailing the captain found his position to be 13 degrees, 50 minutes west of Plymouth; but the chronometer gave 15 degrees, 40 minutes, and the timekeeper was at once pronounced worthless. But the sight of land the next morning proved the captain to have been in error; and when the ship arrived at Port Royal, the voyage of 81 days, the chronometer was found to be 2 seconds slow. On their return to Portsmouth, after a voyage of about five months, the variation had amounted to one minute and five seconds, which gave an error of 16 miles of longitude.

A further test was allowed, and the younger Harrison undertook a voyage to Barbados, during which his chronometer performed wonderfully well.

At a meeting of the Board of Longitude, held February 9th, 1765, it was unanimously declared that the performance of Harrison's chronometer justly entitled him to the reward of £20,000; but that until he had taken out a patent for his Commission the mechanism of it, he should only be paid £10,000. It was not until 1773 that he succeeded in obtaining the remaining £10,000.

He is described as a man of a penetrating and very ingenious mechanic, but he utterly failed when he attempted to describe one of his inventions; he was a most miserable talker. He became quite famous, and of course had to sit for artists with the chisel, the brush and the graving tool.

Harrison died March 24th, 1776, aged 83 years, and was laid in Hampstead churchyard. He left a son and daughter, who seem to have had a jolly row on the sea, and who were at last very amicably settled by an agreement that the

survivor of the two should do just as he or she pleased about the matter. The daughter died first and the son immediately erected the loudest kind of a monument. It must have been heard a long way, for the sexton informed a visitor that at least 10,000 persons had viewed it within three months after its erection.

After Harrison, the chief improvers of the chronometer were Earnshaw, who is credited with the invention of the detached escapement; Arnold, the inventor of the cylindrical hair spring; and Thomas Mudge. By their efforts the chronometer was brought into nearly its present state of perfection. Very slight changes only have been made in the last 100 years.

Harrison used a curl acting on the hair spring to counteract the changes of temperature, the same as we see occasionally in watches; but Earnshaw invented the laminated balance, which has stood firm against all competitors to this day.

The great secret of timekeeping lies in compensation for changes of temperature. It has been found by very careful and delicate experiments that the loss of a watch with a plain brass balance, in passing from 32 degrees to 92 degrees Fahrenheit, is

From expansion of balance 62 seconds
From loss of spring's elastic force 312 "
From elongation of the spring . . . 19 "

Making a total loss of 393 seconds, or 6 minutes, 33 seconds. This amounts to over 6½ seconds for every degree of temperature in 24 hours.

It has been found by equally accurate experiments that the compensation balance, as invented by Earnshaw, will correct this error to within one-tenth of a second for every degree of temperature passed through in twenty-four hours; and no other method of compensation has ever been found to correct the error so nearly as the laminated balance.

In this balance the bar and inside of the rim are of the finest cast steel, on to which is milled so much brass, that when turned and finished up the brass part of the rim will be just twice as thick as the steel. Then a screw with a large head is fitted in the rim at each end of the bar. These are termed timing screws and have no effect on the compensation.

When the hair spring and balance are nearly in accord with the number of vibrations in an hour, these screws are turned out to make the vibrations slower, and in to make them faster. Regulators are never used in ship or pocket chronometers.

The various operations connected with balance-making require the most skillful operators, and even with the most skillful manipulations very many balances are tried and found wanting.

When the chronometer is ready for testing, it is brought very near to mean time by the timing screws; then a note is taken of its rate or variation. It is then placed in an oven heat at about 85 to 90 degrees and run for 12 hours. Then it is run for 12 hours in a refrigerator at about 40 degrees, and each rate noted. It is usual to repeat this trial to see if they agree. When they agree, the balance is pronounced a success.

Every maker tests his instruments thoroughly, but unless they are tested at the Government Observatory and stand well up in the lists they do not become popular.

At the beginning of each year, all those desirous of having their instruments officially tested send them to the Government Observatory, where they are kept and tormented for about 30 weeks. Formerly prizes were given to those heading the list, but none are given at present. When the days of probation are ended, the chronometer goes forth on a mission second to that of no other instrument made by the hand of man.

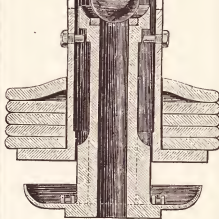
Not until the ship is ready to sail is the chronometer taken on board. It is always accompanied by a statement of its variation and daily rate of variation from mean Greenwich time. It must be carried on board with the least possible jar and a certainty that it gets no upset air. When it is taken to the balance. During the voyage, the utmost care must be taken that it does not run down, as when wound again it is very likely to change its rate. Just as soon as the ship arrives in port, the chronometer is sent on shore to another maker, who keeps an exact record of its performance until the ship is ready for sea again. It will not do to keep it on board, subject to the jars and concussions of the loading and unloading of the ship. In fact, everything that can be done to ensure the accuracy of timekeeping, "and I may add," said Mr. Bradley, "they get it."

"I was shown," continued he, "a fine chronometer that had been on 2½ years on a ship trading between this port and Liverpool, and on every voyage its daily rate of variation had been eight-tenths, while in Liverpool it had been rated every voyage at seven-tenths."

Eave's Deadweight Safety Valve.

WE subjoin an engraving of Eave's deadweight safety valve, which was exhibited by the makers, Sir John Brown & Co., at a recent conference of the Institution of Civil Engineers in London. The valve is formed of a true sphere, made sufficiently large in diameter to be capable of being moved round by the attendant, so as to present a fresh face to the seating, and which can be so moved a number of times without any one face intersecting another; thus enabling him to start again with a tight valve each time the ball is moved. The cage of the steam for carrying the weights is suspended by means of a concave centre-piece lined with soft metal, which, while protecting the ball from injury, allows the weights to hang perfectly free and plumb. This concave centre-piece is also carried low enough, and in such a manner as to form a projection or lip for the escaping steam to flow against. A cup being formed at the top of the stand-pipe immediately underneath the ball, the escaping steam plays upon the lower hemisphere of the ball, and also against the projection or lip before mentioned, thus creating a lip opening sufficiently great to allow the steam to escape as fast as the boiler can generate it, and this with an exceedingly small increase of pressure.

The valve has no parts about it to cause friction, and hence it is extremely sensitive and it is impossible for it to get fast; it also possesses the advantage of closing within a few ounces of the pressure



at which it commences blowing. A lever is provided for lifting the weights, so as to enable the attendant to blow the steam out of the boiler quickly to the Corioli mites have shown an air temperature rising to 113 degrees Fah. The hottest water reported in a Welsh mine was at 125 degrees Fah. —J. A. Phillips. In the Cornish mines, according to Professor Church, who has lately described the conditions, the air is never hotter than the rock, as it is in Cornish mines, and the rock in the lower levels—1,000 feet to 2,000 feet—appears to have a pretty uniform temperature of 130 degrees Fah. The readings were obtained by placing a thermometer in ordinary drill-holes, 10 inches to 3 feet in depth, immediately these were finished, and keeping them there ten minutes to half an hour. The mining in the Cornish proceeds with remarkable rapidity, the drift being advanced 3 feet, 5 feet, and sometimes even 8 feet or to a day, so that there could not be any sensible diminution of heat at the bottom of a drill-hole. The temperature of the rock is more fluctuating than that of the rock, for the simple reason that it is artificially supplied to the mine. In freshly-opened ground it varied from 108 degrees to 116 degrees Fah, but higher temperatures are reported at various points, reaching 123 degrees Fah. In one case. The water reaches much higher temperatures—150 degrees Fah, and upwards. One small stream that had flowed 150 feet over the bottom of a closed drift with little evaporation gave 157 degrees Fah. Belts of excessively hot ground are often met with in these mines, and also, though fewer in number, belts of unusually cold rock.

Pumping Engines at Chiswick Drainage

Works.—See Engraving, page 160.

CHISWICK is situated on the Thames River, seven and one-half miles southwest of St. Paul's, London. Its population is at present 10,000. A system of drainage for the town has, however, been devised and completed by Mr. Henry Oliver Smith, Engineer of the Chiswick Improvement Commission, which has capacity for a town of twice the population. This work was commenced in the summer of 1877. The object is to separate the contaminating matters from sewage water for use in fertilizing soil, while at the same time perfect drainage is secured not only for sewage water proper, but also for rain water, which passes from the roofs into the sewers. The works present many features of interest. We shall, however, confine ourselves to the pumping engines, an illustration of which we give on the first page of this number.

Before describing the engines we will, however, state that every essential feature of the pumping plant has been constructed in duplicate, in order that there may be no interruption to the drainage when repairs are needed. The capacity of the works has been calculated for a maximum of 1,200,000 gallons per diem, which, as already intimated, is double the maximum required for the present wet weather flow of the town.

The description of these beautiful engines is condensed from *The Engineer* of June 6th, which also contains a pretty full description of the entire drainage works.

The engines were designed by Mr. Henry Davey, and constructed on his patent by Messrs. Hathorn & Davey, of Leeds. One of the two pairs now at Chiswick was exhibited by the makers with other machinery at Paris, where it gained a gold medal, and where its extreme simplicity of design and directness of action contrasted very favorably with the very opposite characteristics shown in most of the pumping machinery of foreign design.

They are of a type differing somewhat from any of the "compound" engines formerly made, and showing some advantages as compared with them. The two pairs are identical. Each pair has two cylinders 10 inches and 20 inches in diameter, respectively, and 3 feet stroke, placed vertically side by side, both high and low pressure cylinders being jacketed. Two cylindrical rocking valves placed between the cylinders (as shown in the engraving) suffice for the whole steam distribution; there is no intermediate receiver. Each valve chamber communicates freely with the steam pipe when the stop valve is open, and has besides three ports, one to each cylinder and one for exhaust. In cross section the valve resembles an ordinary D slide with more lap at one end than at the other. The auxiliary steam cylinder and the catamaract cylinder are placed vertically one above the other beside the high-pressure cylinder. The valve gear is actuated by a pin upon a disk on the end of the main gudgeon, the connection between pin and disk being such that the stroke of the former can be changed at pleasure. By means of a vertical link the pin gives a rocking motion to a short weight below the table, through levers on which one link drives the free end of the main valve lever and another the valve of the auxiliary steam cylinder.

The two piston rods are prolonged downwards and connected directly to the upper ends of the pump plungers. The pumps themselves are of the bucket and plunger type, with 21-inch buckets and 15-inch plungers. The pair of pumps are capable of lifting the full quantity of 1,200,000 gallons of sewage in twelve hours, as already mentioned, the total height of the lift being 21 feet 6 inches. The two pump rods of each pair of engines are connected by a pair of parallel links, the lower of which is connected with the upper end of each plunger by double links. The arrangement secures a capital one both for equalizing the work and for forming a steady piston. The amount of work transmitted by the beam is of course very small, so that the whole gearing connected with it can be made very light. The condenser of each engine is a cylindrical vessel placed between the two main plungers, the condenser being placed on the lower of the latter and worked by an arm on the plunger head.

COFFEE AN ANTIDOTE FOR STRYCHNINE.—Dr. Attilio Lelli, having met with a case in which a large quantity of strychnine was administered in coffee without fatal consequences, was led to institute some experiments upon rabbits, and found that coffee either acts as a complete antidote in preventing the poisonous effects of the strychnine, or that it materially diminishes the violence of its action.

THE University Library of Strasbourg has, according to the latest news, now reached the total of 470,000 volumes.

Special Machines Manufactured by the L. B. Flanders Machine Works.

Three machines herewith illustrated are designed for the special performance of three kinds of engine repairing *in situ*, thus saving the labor of taking engines apart, adjusting the parts to be refitted in lathes, etc., and reassembling the parts after the work has been performed. The three classes of work the machines are severally designed to perform are the turning off of crank-pins of locomotives in position, and while the wheels are under the engine; the facing off of worn valve-seats without removing cylinders of locomotive and other steam engines, and the boring out of cylinders without removing them from their position. The machines perform their work accurately and quickly, and effect a large saving in labor and time, the latter being a very important consideration in most cases wherein the repairs named are needed.

We illustrate the crank-pin machine in Fig. 1. It is fastened, by means of scroll and self-centering jaws at one end, to the collar of the pin, upon which there is no wear; it is then clamped in position by bolts passing through the spokes of driver. The tail stock center is then run up, and if the pin is not bent it will exactly fit the old center, holding the outer end true; if it does not come exactly central, the tool is pushed down and turned around the outer collar, showing exactly all the variation; the old center is then chipped off, and it does fit. In this manner the original center of the pin is either maintained or restored if the pin has been bent.

The engraving shows the cutter-bar and its gear driven and fed either way by the crank and intermediate gearing, which gives motion to the screw. The cutter is bent and fastened by a set-screw in the extreme end of the cutter-bar, and is readily applied to the work and fed by a nut moved by a screw as before mentioned. The boring attachment for truing up holes after being worn by a loose pin, is very quickly attached and adjusted to cut any size required.

Some recent improvements have been incorporated in this machine, which add much to its former efficiency.

Fig. 2 illustrates a valve-seat rotary planing machine, by which a valve seat may be re-faced with a great saving in time and labor over old methods; also, a saving in loss, as no filing is required.

The job may be done accurately, as the plates are set true with the uniform parts of the valve-seat, and, consequently, the new face will be likewise true. The work done is exactly in line with the travel of the valve stem, thereby preventing the yoke from slipping up and down the valve, as well as all extra friction on the valve stem. No more material need be removed than is absolutely necessary to true up, thus saving the seat. The work is done by a continuous cut, and the loss of time from the return motion of the ordinary planer avoided. There is also no breaking out of the edges.

From seventy to eighty per cent. of the labor required by old methods is saved, which, added to a total saving in cost of files, makes a very important advance in economy.

There are two horizontal disks, the upper secured by radial arms, adjusted to suit the position of the studs in the valve seat; the lower, carrying the cutter and its slide, revolves freely against the upper, and is held in place by a king-bolt passing through its centre. This lower plate is also secured by a circular gib upon its circumference, which admits of taking up the wear. It is an annular gear, having teeth cut on its inner periphery, from which it receives its rotary motion by means of its connections with the level gears and crank. The crank may be replaced by a pulley if power be convenient. The double bevel shaft acts like a back gear and admits of a change of speed. Either level is thrown into gear at pleasure by the movement of a pin in a slot operated by the hand-wheel. If the outer bevel is in action, it gears directly into the lower plate; if the inner bevel, it is slow geared to the outer, and that to the plate. The revolving lower plate is fitted with the V-slide and the tool-post, and is fed by a screw and star-wheel, arranged to give a large variety of feeds, from roughing to finishing, etc. The cutter is conveniently fed down by the operation of a nut on the cutter-spindle acting against the tool-post. The radial arms which secure this machine to the studs are so finished with joints to give a wide range of adjustment. The nuts and their bearings, in

the washers which jam the radial arms, are curved to admit of their being firmly secured without springing the machine, even though the studs should be a little out of line. In case the studs, being in a small valve-seat should come inside the plates, four other radial arms are furnished with the machine, fitted with a T-slot, and with a hole at the other end corresponding to the hole for the old stud, thus admitting of their being used in cases.

After the seat is planed the machine can be lifted

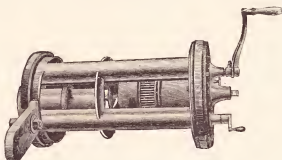


FIG. 1.

off and placed on a table, which is supplied with stationary adjusting columns and chuck for holding the valve, then the *valve* is planed. In many instances, when the work is done in round houses, the table is essential to a more perfect and satisfactory job. It is estimated that an ordinary locomotive valve-seat can be thoroughly trued up in two hours. A case is on record where a tug-boat, which was laid up with a tow on account of a cut valve-seat was in motion again two hours after the arrival of this apparatus. The machine is strong and well fitted up, easily handled and an excellent tool in every respect. It is principally used in three sizes, 18, 22 and 26 inches. The 22 size is sufficient

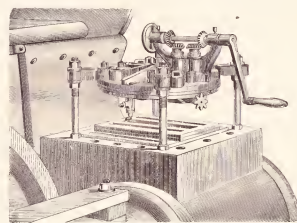


FIG. 2.

for all but the very largest class of locomotives. All the wearing surfaces are carefully scraped by hand, and the machines are all thoroughly tested before being shipped from the works. The demand for these machines is increasing daily, their importance being appreciated by master mechanics.

The compact, simple and beautiful tool shown in Fig. 3 is the locomotive cylinder boring machine, which conforms to the general principle of working to original centres that is a feature of all these tools.

It is especially adapted to boring out locomotive cylinders in their places by removing only one or both heads and piston. Cutter heads are furnished for boring driving boxes. The back-head, cross-

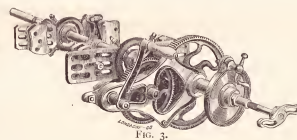


FIG. 3.

head or slides need not be removed unless so desired. On removing the piston and leaving the front-head and stuffing-box, a small cone takes the place of the slide stuffing-box, and, with proper adjustment at the front-head is ready for work. This machine is fed with a constant feed of cut gears. The clamps or cross-heads are so arranged that they may be used conveniently on locomotive cylinders of all sizes, which is a great improvement over the old machine.

The address of the L. B. Flanders Machine Works is No. 1,125 Hamilton Street, Philadelphia, Pa.

The Recent Eruption of Etna.*

PROF. SILVESTRI has just issued his report to the Italian Academy on the recent eruption of Etna. It is a quarto pamphlet of nineteen pages, accompanied by a capital map, showing the exact extent and dimensions of the lava streams.

Silvestri considers that the preparations for this eruption have been continued since 1874, and that this is the fulfillment of the abortive attempt which was then made. On August 29th, 1874, a rift opened on the north-east side of the mountain, between the great crater and Mojo, and thirty-five small eruptive mouths were formed along its course, together with one larger crateriform mouth, which discharged lava. But after seven hours of activity, the dynamic forces suddenly decreased in intensity, and in two days' time nothing remained of the eruption save a few secondary manifestations. For a fortnight afterwards, however, earthquakes occurred on the north side of the mountain, and the great rift remained open. Silvestri predicts that when the next eruption came this rift would prove the point of least resistance, and that the new lava would flow from it, or from craters raised along its course. This prediction has been completely verified.

The fissure of 1874 has extended itself—on the north-north-east towards Mojo, on the south-south-west towards Aderno. It is 6 1/2 miles in length, and passes through the great crater of Etna. On May 26th, the south-western extremity discharged lava in the direction of Aderno, while simultaneously the north-eastern extremity discharged lava in the direction of Mojo, thus presenting the curious anomaly of twin eruptions on opposite sides of the mountain. The craters on the south side of the mountain were situated on the base of Monte Frumento, 8,743 feet above the sea. There were eight eruptive mouths, from four to fifteen metres in diameter; seven of these were open, while over the eighth was raised a conical mound. The lava did not flow directly towards Aderno, but towards a series of moults formed during a previous eruption. It accumulated against the first of these mounds, and then divided into two branches, one of which commenced to flow towards Aderno and the other towards Biancavilla, but the supply died out at the source, and the new streams solidified at a height of 2,000 metres, having flowed for a mile and a quarter as a stream 400 metres in breadth. This stream did but little damage; it did not penetrate into the cultivated region, and but a short distance into the woody region. It came in contact, however, with a bed of snow, part of which it converted into clouds of steam, while another portion was liquefied, and rushed down the sides of the mountain in a foaming torrent, carrying with it a good deal of debris.

The outflow of lava ceased on the south side of the mountain, because the lava found a vent at a lower level on the north side. As the one decreased in activity the other increased. On May 28th Silvestri visited the scene of the northern eruption. A great column of smoke appeared about 20 degrees east of north, while a shower of sand descended, producing the "sad ladder light" observable during an eclipse. More than two pounds of this sand were collected in ten minutes, and was in an inverted umbrella, and the north flanks of the mountain were soon covered with it. Silvestri ascended towards the new craters, and when at a height of about 2,200 metres he heard loud subterranean detonations, and perceived severe oscillations of the soil. Frequent flashes of lightning issued from the smoke. The stream of lava near its source emitted a very bright light, which, when viewed by a direct vision spectroscopic, gave the lines of hydrogen, calcium, sodium and potassium. The lava flowed downwards at a rapid rate; the wood of Collesasso was destroyed, and by the evening of May 29th it had flowed six and a quarter miles, destroying the bridge of Sasso Pisciaro and crossing the postal road between Randazzo and Linguaglossa. On Sunday, the 31st, the stream was rapidly approaching Mojo; the inhabitants became frightened, and brought out the figure of their patron Saint Antonio, which was carried in pro-

* Condensed from *Nature*.

cession to the edge of the stream, while the people fell on their knees and besought the Deity to save them from the impending danger. After the evening of June 1st the force of the eruption began somewhat to abate, and by the 6th instant it was practically at an end. The lava stream ran nearly seven miles from its source, and ultimately stopped 500 yards from the river Alcantara, and about half a mile from the village of Mojo. At its termination it is twenty-three feet in breadth and nearly thirty-two feet in height. In seventy-six hours the lava flowed more than six miles from its source.

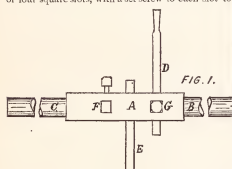
Indications of a disturbed volcanic condition were manifest last October, when powerful shocks of earthquake were felt. Mineo was the centre of disturbance, and here the shocks continued at intervals during the month of October. Loud subterranean noises were also heard at intervals. Two months later an eruption of mud and gas took place on the southern flanks of Etna. The mud was hot, salt and petroleum-bearing, and its ejection continued for several months. Towards the end of December last the whole eastern seaboard was visited by a strong shock of earthquake; and soon afterwards a great increase of smoke from the central crater of Etna showed that the dynamic activity of the mountain was unusually near the surface.

Even now we cannot regard the eruption as at an end. There is evidently a great deal of volcanic energy still pent up not far from the surface, and we must fear that before long a further outburst will relieve the imprisoned Titanic forces.

Turning Small Pieces of Duplicate Form.

BY JOSHUA ROSE, M.E.

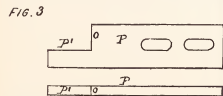
WHEN a number of small pieces of duplicate form are to be turned by hand, a great deal of measuring may be saved and the work very much expedited by means of the device shown in Fig. 1. It consists of a tool stock or holder, the middle of which, denoted by A, is square, and contains three or four square slots, with a set screw to each slot to



hold different turning tools. Each end of the stock is turned parallel, as denoted by B, C. In Figs. 1 and 2, D, E and F are the tools, and G, H, are the set screws.

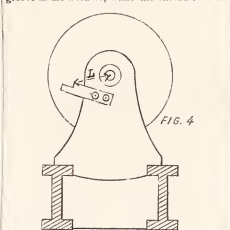
Fig. 3 represents top and side view of a plate of which there must be two, one to fasten on the head stock of the lathe, as shown in Fig. 4. In Fig. 5 the manner of using the tool is shown, similar letters denoting similar parts in all the figures.

The plates P P are bolted by screws to the head block H and the tail stock T of the lathe. The tool holder is placed so that the cylindrical ends B C rest on the ends of these plates and in the angles P P'. The cutting tool D is sustained, as shown upon the lathe rest R. In use the operator holds the stock A in his hands in the most convenient manner, using the tool E as a handle when there is a tool in the position of E. The cutting point of the tool is pressed up to the work W, and the feed is carried along by hand. It is ob-



vious, however, that when the perimeters of A B meet the shoulders O O, Fig. 3, of the plates P P, the tool cannot approach any nearer to the diam-

etrical centre of the work, hence the diameter to which the tool will turn is determined by the distance of the shoulders O of the plates P from the centre of the lathe centres, as shown in Fig. 4 by the line L. In carrying the cut along it is also obvious that the lateral travel of the stock or holder must end when the end of the square part A comes against the side face of either of the plates. In our engraving we have shown the tool D cutting a groove in the work W, while the shoulder of the



holder is against the plate fastened to the lathe tail stock T; and so long as the operator, in each case, keeps the shoulder against that plate, the grooves upon each piece of work will be cut in the same position, for it will be observed that the position in the length of the work performed by each tool is determined by the distance of the cutting part of each tool from the end of the square part A of the tool holder. All that is necessary, then, is to adjust just each tool so that it projects the proper distance to turn the requisite diameter and still the required distance from the shoulders of the square to cut to the desired length, and when once set error cannot occur.

This plain description of the device, however, does not convey an adequate idea of its importance. Suppose, for example, that it is required to turn a number of duplicate pieces, each with a certain taper. All that is necessary is to adjust the plates P

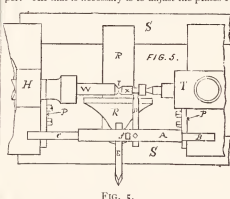


FIG. 5.

in their distances from the lathe centres. If the large end of the taper on the work is required to stand nearest the lathe head stock H, the plate P on the head stock must be moved until its shoulder O is farther from the lathe centre. If, however, the work requires to be made parallel, the plates P must be set the same distance for the axial line of the centres. If it be desired to have a parallel and a taper in proximity upon the same piece of work, the tool must have one of its cylindrical ends taper and use it upon the taper part of the work.

In Fig. 5 the tool D is shown cutting a square groove. The tool at Z serves to turn the parallel part A, and the tool E would cut the V-shaped groove I.

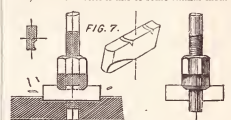
All kinds of irregular work may be turned by varying the parallelism and form of the cylindrical ends B C; but in this event the shoulders O O, Fig. 3, should be made V-shaped and hardened to prevent them from rapid wear.

A SINGULAR ACCIDENT occurred on the 13th ult. in the granary of Messrs. Lelievre & Sons, Havre. Fifteen thousand sacks of corn had been stowed in the front floors, and the workmen were engaged in unloading a van, when suddenly the front wall of the building was observed to shake and finally give way, falling with a terrible crash into the street. The whole wall, from the ground to the roof, a height of about 40 feet, had given way under the semi-fluid pressure of the corn, scarcely a single brick remaining.

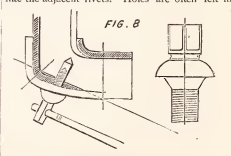
Locomotive Fireboxes.*

II.

THE copper tube-plate may be drilled conveniently with a vertical multiple drill, a number of holes of a sufficient size to allow the spindles of the tube-plate drills to move in them easily being first drilled most carefully to centre marks. These drills (see Fig. 7) consist of steel spindles about $\frac{3}{4}$ of an inch diameter, with a slot cut in them like a cutter bar for the drilling tool. This tool is centered first into the spindle, and when turned to size and also nicked at the top so that a ferrule that fits round the spindle and has a pointed edge may fix it when the drill is finished instead of the cutter. This ferrule is pushed against the cutting tool by a nut working on the spindle, which is screwed with a fine thread to receive it. We thus see that if the $\frac{3}{4}$ holes have been drilled correctly the 2 in. holes will follow them truly, and if the first holes are drilled at all oval the spindle will follow its shape if at all slack, in the same way that a common drill will wobble if badly started. The action of the cutter is the same as that of a cylinder drill. It would indeed, we think, be much better if this or some similar meth-



od were more adopted for horizontal boring. It looks so bad to see a cutter bar going round in jerks just as it came across hard and soft places, and cutting with only one edge, perhaps, the boring-bar often bending (especially when the casting being bored does not admit of stays near the tool), to suit the hole bored out in the casting, generally anything but round, the sole reason being that the cutter-hole is not square or the cutters slip. It is of the greatest consequence to drill the holes evenly in the tube-plates, as there is always very little metal left between the holes, and this gets strained in fixing the tubes. The crown of the copper box is often, also, stayed by long bolts tapped into the tool and the fire-box-shell, and riveted over the heads. We prefer roof stay bars. Room must be left between the roof stay bars for the longitudinal stays. The fire-door ring is forged of one piece, and placed front and back. The fire-box bottom-ring is made of two forgings welded in the centre of the sides, not at the corners. As it would be impossible to rivet the bottom-ring to the copper box and fire-box rings in the corners, such use is made use of (see Fig. 8), having heads that have square tops, to allow them to be screwed in, which are afterwards taken off, and the head filed, to look like the adjacent rivets. Holes are often left in



the bottom ring for mud-plugs, fastened to a steam-tight seat on the ring by a nut and bolt. The bottom-ring has frequently, also, four stays forged at the bottom of the sides for bolts to hold the ashpan. Roof stay bars are forged of scrap, of a corrugated form, to allow thickness for bolts, and sometimes forged the full thickness throughout. They are drilled either partially or right through, according to the arrangement of bolts, in a vertical multiple drill, and screwed by machine. A word as to multiple drilling. It is all very well for some jobs, tube-plates, etc., but it must be recollected that there is much more gear to keep in order, more tools to be kept in order, and the same size, and nearly the same length; and if one drill goes wrong, often the others have all to be stopped. Another thing, if a drill breaks, it will not, as in a single drill, stop the drill and throw off the strap, but will go on grinding away till it probably unseats the work, and in the case of drilling roof stay bars, where the roof stay bars are swimming in water, the water has all to be tapped off and the machine stopped before it is possible to tell the bad tool. The same difficulty occurs, to a certain

*F. Hoffman in *English Mechanic*.

extent, in tapping these staves, or in tapping any thing except nuts and similar work; the workman cannot feel his work progress. Any one who pays for his own taps will soon learn how far he can go with them, and whether the hole has been drilled too small at first, and it is sometimes no easy task to get one out of a large piece of iron like a staff, or, especially if the tap is, so to speak, "crumbly," from overheating when it was tempered.

The Lemming.

SOME time since the *Popular Science Monthly* published quite an elaborate account of this singular animal, whose habits are a problem to naturalists. We notice another article upon the same subject in a foreign magazine, from which we can conveniently condense a sufficient description to give our readers an idea of this curious creature.

The lemming is an animal resembling a large rat. In fact, it belongs to the same family of creatures. It is found in Norway, and burrows in the earth. It is a migrating rodent and its undeviating adherence to straight lines of march is the remarkable feature of its migration. The lemmings march in parallel lines from the mountains down through lakes and rivers, and are said to even eat their way through corn-stacks rather than deviate from the straight line of march. Many unreliable statements are made relative to their marches, but, sifting opinions from facts, it may be said that the lemmings are in the habit of making emigration-movements at irregular intervals; that they pursue a straight course, and may swim across rivers, lakes, or even be found in the sea itself, and, lastly, that their progress appears to be invariably directed to the sea. In this latter remark will be found the clue to the causes of lemming migration.

It is exactly this curious and apparently unsatisfactory termination to their journey which has not merely excited the interest of the naturalists in the lemmings, but has in a large degree aided in the solution of the problem their migrations present. The period of the year at which the migrations of the lemmings occur is not invariably in winter or before weather of inclement nature, as one theory professes to maintain. It was supposed that these animals left their native haunts through a fore-knowledge of a severe winter. But migrations have occurred in the spring, when all fear of starvation was practically at an end, and migrations have been noted also to take place after an autumn of unusual plenty.

"The "starvation hypothesis" and the "weather theory" are alike unable to meet the facts of the case as presented to our notice in its full details. A third theory which endeavored to account for the periodical exodus of these animals was founded on Malthusian considerations, and regarded the over-population of a given district as the chief incentive to the migratory act. But, so far as exact observation has proceeded, the excessive population seems to be rather the result than the cause of the migration. As if further to refute the idea of over-population and the consequent deficiency of food being the causes of the exodus, we may note the fact that during their journeys the wandering hordes of lemmings frequently light upon a land wherein plenty of food exists, but that, instead of sojourning therein and satisfying their wants, they pass onwards and seawards without a halt. Nor must the fact be overlooked that, as Pennant tells us, their march is practically one of extermination for themselves. Their ranks are devastated by every carnivorous animal, even by every bird of prey that cares to track them. They are also liable to be terrified by the mere shadow of a passing cloud. When they swim across Norwegian "fjords" and lakes, the ripples caused by the summer wind drown them by hundreds. The appearance of a boat causes them to turn tail and swim back to the shore; and the migratory band, which numbered its myriads on setting out upon its march, reaches the end of its journey at the sea, and appears as a single speck on the once formidable host. Whatever be the cause of the migration, it is perfectly obvious that the exodus is attended with no advantage to the lemming race. In fact, the result of the migration is precisely the thinning out of the species, and the destruction of countless thousands of the race—this result, however determined, being a disadvantage as far as the animals are concerned, since it is the universal law of life and nature that each species "fights for its own kind." They exhibit no instinct in selecting an easy route, but, on the contrary, migrate by lines of march wherein they encounter the greatest hardships and difficulties from broad lakes, rushing torrents of the Zuyder Zee, and mountains. One series of careful observations on the lines of march of these animals, for instance, reveals the interesting fact that whilst the lemmings, by a slight detour, are enabled to avoid a deep and rapid river and a broad lake, they crowd the banks with the result of grievously thinning their ranks, besides passing over elevated ridges of land

and snowy mountains where their numbers were materially lessened by the attack of their enemies. The straight line from any district to the sea is thus practically the track selected by the lemmings; some of the hordes going eastward in Norway to the Gulf of Bothnia, and others westward to the Atlantic. It appears to be a rare occurrence for these animals to march southward.

The purposeless nature of the migration of these animals is nowhere better viewed than at the termination of their strange journey, when the death hordes have arrived at the sea. There the survivors disappear from sight. Many die; a large proportion perish in the sea; some may sustain a precarious existence in a region to which they are strangers, and compared with which their native haunts were lands of plenty; but practically the exodus of the lemmings is devoid of advantage and fraught with disadvantage, danger and ultimate death by drowning to the species at large. How, then, may this strange habit be explained? The answer is, by reference to the altered character of the continent of Europe; or, speaking more generally, by taking into account the physical changes to which the world at large has been subject, and which, it is well understood, it still undergoes.

On this theory we may learn the reason why these animals commit themselves fearlessly to the Atlantic waves, since the instinct which has led them across their native lakes and friths will undoubtedly inspire them with the idea that across the ocean lies the ancient feeding-ground of their race—a family tradition this which, like many ideas in higher life, operates disadvantageously to its possessor. The existence of submerged land in the North Atlantic is by no means a merely theoretical supposition. The shallowness of soundings taken off the Norwegian shores, and the presence of elevated ridges in the bosom of the Atlantic, indicate that the depression of this area may have been—geologically speaking—a recent event. But apart from these latter data, the case of the lemmings can be fully explained only on the theory that they seek an ancient haven of their race, in the form of a land which the existing world knows no longer, and which, through its subsidence, has disappeared in the depths of the sea.

A Supposed Shower of Sulphur from Mount Etna Explained.

The following is an interesting and instructive letter to *Nature*, published in the issue of that journal for June 26th.

The following paragraph appeared in the *London Times* of June 16th:

"During the past week, after heavy rain, a thin film of sulphur has been observed at Windsor, Slough, and in the neighborhood generally, to settle upon the surface of rain-water caught in lulls and cisterns. The phenomenon did not at first attract much attention, but being observed on different occasions it has given rise to much speculation as to the cause of it, there being no manufactures in the neighborhood at all likely to have produced it. It has been suggested that a sulphurous vapor may have been wafted to the country by the recent south-east winds, and arrested and deposited in the rain."

The supposed "sulphur rain," a fine yellow dust, was the cause of great excitement among the country people in this neighborhood. It was first observed on the afternoon of Sunday, June 8th, after a remarkably heavy shower, and much distress to the inhabitants of some of the villages round Eton, who fancied that it smelt "awful like brimstone," of which its yellow color was somewhat suggestive. In some places it gave rise to such a feeling of fright that the people were afraid to go to bed, the thing that was just mentioned being at hand. Two or three days afterward there was another "sulphur" shower, and I collected a quantity of the dust with my pupils, who were at the time using my laboratory for the time. One of them, I. Lury, immediately recognized its resemblance to the pollen of *Pinus pinaster*, with which he is familiar from its abundance in the neighborhood of his home at Bournemouth; and we have none of us any doubt but that the so-called sulphur is the pollen of this tree, or of the Scotch fir, *Pinus sylvestris*, both of which are common in Windsor Forest. Two of the Windsor doctors, both practical microscopists, at once came to the same conclusion; but a local chemist and druggist is said (on good authority) to have supported the sulphur theory. This, perhaps, accounts for the rather positive statement by the Windsor chemist, that the "sulphurous vapor" is not a deposit, and also for the suggestion he refers to respecting its origin, which explains the phenomenon in a manner that is certainly more curious than probable, from a chemical point of view. I hear that the "sulphurous vapor" is supposed to have been "wafted to this country," after escaping from Etna during the recent eruptions, which for-

tunately occurred at just the right time to give apparent probability to the sulphur theory.

Thinking that such a remarkable phenomenon should not be allowed to pass unnoticed, I sent a short note to the *Times* of the 17th inst., stating the real (pollen) nature of the yellow dust, hoping that this would set the matter at rest and dispel the superstitious fears of the rustic. I was therefore greatly surprised, a few days afterward, at receiving a letter from an F. R. G. S., residing near Carlisle, in Ireland, who had seen my note in the *Times*, and out reverently asked me to send him some of the sulphur" in his neighborhood. He was good enough to enclose me a "specimen of its encrustations" on a dead leaf, and said that "last yesterday's heavy rains have given us some like that I send you might have been gathered, and the edges of the pools of water were heavily encrusted with pure sulphur." He added that he thought I should not find the deposit to be "the produce of *Pinus pinaster*." This, of course, was rather startling, for I naturally supposed that no one would write so confidently who had not satisfied himself by chemical tests and by microscopical examination as to the truth of his statements, especially in the case of the mistake which had been made in England, and I am at the deposit under the microscope, however, revealed its true nature—pine-pollen again!

I wrote accordingly to my informant, telling him this, and sending him some pollen taken directly from the tree, so that he might recognize its similarity to the "pure sulphur" he so kindly sent me. I hope that by this time he has done so.

The above facts are of interest, partly as affording an excellent illustration of the transportation of pollen by the wind, and partly because they show how ready some people are to attribute an almost miraculous origin to anything a trifle out of the common, which could be readily explained by one possessing a little elementary knowledge of science.

F. HERBERT CARPENTER.

The Museum, Eton College, June 21.

Peppard's Electric Torpedo Balloon.

For the SCIENTIFIC NEWS.

The Electric Torpedo Balloon is the invention of P. Peppard, of Basking Ridge, N. J. A partial description of it was published in the *Scientific American* in the summer of 1877. In this balloon the means of dropping the torpedo at any instant desired is the electric current. A small balloon capable of carrying from 10 to 50 pounds of nitro-glycerine is all that is desired. A couple of light electric wires, insulated and encased as one, are attached to a small electro-magnet just under the balloon. This magnet operates a simple and ingenious device, tripping it the instant the torpedo drops, and thus, by allowing the suspended torpedo to drop. The wire plays out on a reel, and at the retained ends a ten-inch Grenet Battery is placed in the circuit to supply the current. The operators get on the windy side of the enemy, for it is to be attacked or blown up, and with a sufficient length of wire attached they allow the balloon to wait up and out of range of shot over the object attacked, and the instant the desired position is reached (this can be readily observed by the use of the sextant glass) the operator presses the finger key, and the current thus sent into the electro-magnet under the balloon operates the detent, and like a flash of lightning, the torpedo drops straight down, and does not explode until it strikes, when it will explode. The dropping of a 500-pound torpedo is said to be sufficient to blow up a whole fort at once; it would, doubtless, kill many from the concussion of the explosion. The few feet of wire can be blown to atoms, when in the ordinary way it would take days and weeks, perhaps, of hard fighting. Such a small balloon could probably be carried by a man after dropping the torpedo, by having a strong rope attached to it so as to reel it in, and thus save the balloon, magnet, &c. The device works instantly and accurately, and costs but very little. No person need be in the balloon.

The portable balloon now used in the army is large enough to carry up torpedoes, and is readily converted into an Electric Torpedo Balloon at a very small expense. Several Governments have inquired into the working details of this balloon, with a view of adopting it into service.

[We give the latter statement simply as communicated to us, the names of the Governments who are said to have made inquiries not having been supplied. We regret that we cannot share the views of the writer of the article as to the precision with which the apparatus can be operated. Winds are notably variable both in speed and direction, and the dropping of a balloon, either free or captive, are often quite a few miles from the proof of the whole matter is a subject of easy and inexpensive experiment, which may show our

opinion to be unfounded. Could torpedoes be thus dropped over vessels, forts or armies in the field, they would prove a terrible means of warfare.—Ed.]

M. DE LESSEPS, it is understood, will shortly issue a prospectus inviting subscriptions for the Panama Canal, and will repair thither in September.

THE WESTMINSTER CLOCK.—Referring to the description of this clock in the SCIENTIFIC NEWS for the first of June, it will be interesting to note that, according to the report of the report, its performance for the past twelve months, the present is the best year but one of the clock's performance, it having been within one second of true time on 80 per cent. of the days of observation.

A SINGULAR disease manifested itself about the middle of July, in the tobacco factory of the Messrs. Lorillard, in Jersey City. Its prominent symptoms were sudden nervous prostration and convulsions. Quite a number of the girls employed were attacked, and had to be carried home. So far as we have learned, none of these cases terminated fatally. The sickness was doubtless due to the combined effect of nicotine and depression caused by heat, as the day on which it occurred was a very hot one. A foolish, if not malicious, attempt to get up a yellow fever scare on the strength of the occurrence signally failed.

CAST NICKEL.—It is said that Herr Fleitmann has succeeded in obtaining cast nickel in a malleable and ductile form, while cobalt prepared in the same manner possessed such hardness when cold that he thinks it could be used for cutting instruments, while hot it is both malleable and ductile. His process consists in adding to the fused metal, through a hole in the lid of the crucible, 15 per cent. of metallic magnesium, which possesses a remarkable power of destroying carbonic oxide. Cobalt prepared in this manner possesses none of the reddish color attributable to iron and nickel, but excelled nickel in whiteness and brilliancy. He also welded these metals to iron and steel at a white heat, and strips thus welded were rolled out to the finest number without separating from each other.

BERNARDINITE is the name of a new mineral resin from San Bernardino County, California. It presents a light, porous, friable mass of a yellowish white color, floating like cork upon water. Fracture, fibrous; specific gravity, 1.466; softens below 100 degrees C., but does not fuse perfectly even at 140 degrees C.; forms an emulsion with water by boiling; dissolves readily in alcohol or ether, and less readily in carbon disulphide. The melting point of the portion extracted by hot alcohol was determined to be 127.9 degrees C. Heated on platinum foil, it burns with a bright flame, with much smoke, leaving a fixed carbon residue. Heated cautiously, a portion distills over. Concentrated sulphuric acid produces a brownish red coloration in the cold, which becomes black on heating. Caustic potassa dissolves it readily, and the solution may be diluted with water to any extent without precipitation, but is precipitated by hydrochloric acid.

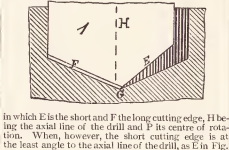
NOVEL APPLICATION OF PAPER.—Numerous instances of new applications of paper and papier maché are reported from time to time in the public press, and scarcely a week passes without some addition being made to the already lengthy list of their various capabilities, but probably few among them are of greater interest than that which we now record. Professor Green, of the Troy Polytechnic Institution, has recently been engaged in the construction of an astronomical observatory, the revolving dome of which was designed to be twenty-nine feet in diameter. Constructed of ordinary materials, a dome of these dimensions would be five or six tons in weight, and would consequently require extremely substantial structures to support it, and a powerful and complicated system of machinery to set it in motion. Pondering over these difficulties, the Professor hit upon the happy idea of having his observatory dome constructed of papier maché, a suggestion which has been carried into practice with complete success by the manufacturer to whom he submitted it. In place of the ordinary heavy structure a light framework of wood has been erected, covered with a dome of paper, so prepared as to be harder and more durable than wood itself, and reduced by enormous pressure to a thickness of one-sixth of an inch only. As thus arranged the total weight of the dome is but one and three-quarters tons instead of the five or six tons originally anticipated, and it can be revolved with the greatest ease without the application of any machinery whatever. Over and above these great advantages the substitution of paper for other material in its construction has been attended by a very considerable diminution of cost.

Shop and House Hints.

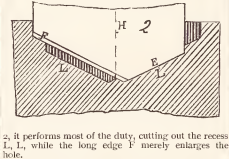
The American Submerged Pump.—The advertisement of which will be found in our advertising column, is an admirable appliance for watering plants, heading down streets, etc., at this season of the year in country villages and other situations, where a natural head of water sufficient for such purposes does not exist. It is one of the simplest, most durable and cheapest pumps in the market.

The Sun Cholera Mixture.—Many years ago the *New York Sun* published the following formula, which has proved so successful that it received the above name and has since been kept for sale in the drug stores under that title. It is probably one of the best remedies for summer complaint ever prepared. Take equal parts of tincture of Cayenne pepper, tincture of opium, tincture of rhubarb, essence of peppermint and spirits of camphor. Mix well. Dose, 15 to 30 drops in a little cold water, according to age and violence of symptoms, repeated every fifteen or twenty minutes until relief is obtained. Taken in time it will prevent cholera, and is a sovereign remedy for colic, diarrhoea, dysentery, etc. It is a simple, cheap remedy, and ought to be kept in every household.

Drill Grinding.—When a drill is ground with the point not in the centre of the drill, and the longest cutting edge is at the least angle to the axial line of the drill, that edge performs all the cutting, as shown in Fig. 1.

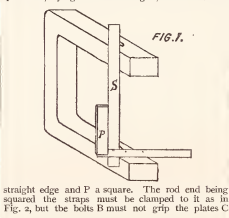


In which E is the short and F the long cutting edge, H being the axial line of the drill and P its centre of rotation. When, however, the short cutting edge is at the least angle to the axial line of the drill, as in Fig.

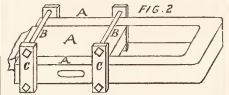


2, it performs most of the duty, cutting out the recess L, while the long edge F merely enlarges the hole.

Fitting Straps.—The difficulty experienced in making the faced keyways of cast-iron straps come true may be obviated by filing the insides of the jaws quite true, trying them as in Fig. 1, in which S is a



straight edge and P a square. The rod end being squared the straps must be clamped to it as in Fig. 2, but the bolts B must not grip the plates C.



while setting the strap; otherwise the latter will spring, and the keyways will not come fair when the strap is free from the plates.

Lemon Verbena.—The well-known fragrant garden variety, the sweet-scented or lemon verbena (*Lippia citrifolia*), seems to have other qualities to recommend it than those of fragrance, for which it is usually cultivated. The author of a recent work, entitled "Among the Spanish People," describes it as being systematically gathered in Spain, where it is regarded as a fine stomachic and cordial. It is either

used in the form of a cold decoction, sweetened, or five or six leaves are put into a teacup, and hot tea poured upon them. The author says that the flavor of the tea thus prepared "is simply delicious, and no one who has drunk his Polve with it will ever again drink it without a sprig of lemon verbena." And he further states that if this is used one need "never suffer from flatulence, never be made nervous or sleepless, never have cholera, diarrhoea or loss of appetite.

Cockroach Poison.—Equal parts of powdered borax, Persian insect powder and powdered colophony, well mixed together, and thrown about such spots as are infested, never fails to exterminate the pest, and affords an effectual means of getting rid of the scourge. This powder, in all cases where its use has been persistent, has by long experience been found an infallible remedy.

List of Patents Granted July 1st and July 8th, 1879.

We will supply copies of any of the patents in this list, post paid, to any address in the United States or Canada, on receipt of 50 cents per copy.

PATENTS GRANTED JULY 1ST, 1879.

Agricultural implement, S. E. Woods and A. H. Well...	217,036
Automatic, W. J. Hinchey...	217,037
Asie, vehicle, P. E. Lasky and W. A. sold...	217,038
Asie, vehicle, G. B. Thompson...	217,039
Baby-walker, J. L. Edel...	217,040
Balances, platform, S. S. Hinchey...	217,041
Belt-band tender, L. Miller...	217,042
Belt-tie wire, A. Buckman...	217,043
Belt-tie wire, J. C. Wright...	217,044
Belt-walker for shoe makers, J. Eckert...	217,045
Battery-carriage, connector for, H. Rodgers...	217,046
Best live attachment, L. C. Lyon...	217,047
Bellows-valve, J. Badger and H. F. Benjamin (re...	217,048
Belt, temporary hook, H. W. Taylor...	217,049
Blast powder, C. Felson...	217,050
Belt roller, steam, H. M. Pierce...	217,051
Belt and shoe heels, manufacture of, B. F. Locke...	217,052
Boss, manufacture of rubber, R. Flynn...	217,053
Bottle-stopper, J. C. Schaffner...	217,054
Bottle, cork, J. D. Stetson...	217,055
Box, W. C. Tuttle...	217,056
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Bricks, and the art of making the same, J. M. ...	217,059
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Buckle, trace, G. M. Harbach...	217,063
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Button, metallic, C. Radcliffe...	217,068
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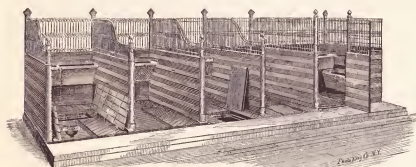
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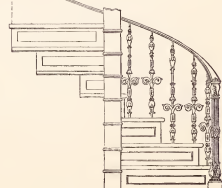
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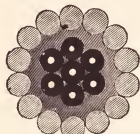
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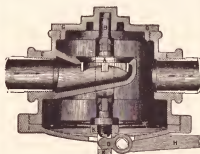
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